

6 DETERMINING ALTERNATIVE RELEASE SCENARIOS

In Chapter 6

- Considerations for alternative release scenarios for regulated substances in Program 2 or Program 3 processes.
- Potential alternative scenarios for releases of flammable substances.

You are required to analyze at least one alternative release scenario for each listed toxic substance you have in a Program 2 or Program 3 process above its threshold quantity. You also are required to analyze one alternative release scenario for flammable substances in Program 2 or 3 processes as a class (i.e., you analyze one scenario involving a flammable substance as a representative scenario for all the regulated flammable substances you have on site in Program 2 or Program 3 processes). You do not need to analyze an alternative scenario for each flammable substance. For example, if you have five listed substances – chlorine, ammonia, hydrogen chloride, propane, and acetylene – above the threshold in Program 2 or 3 processes, you will need to analyze one alternative scenario each for chlorine, ammonia, and hydrogen chloride and a single alternative scenario to cover propane and acetylene (listed flammable substances). Even if you have a substance above the threshold in several processes or locations, you need only analyze one alternative scenario for it.

According to the rule (40 CFR 68.28), alternative scenarios should be more likely to occur than the worst-case scenario and should reach an endpoint offsite, unless no such scenario exists. Release scenarios considered should include, but are not limited to, the following:

- Transfer hose releases due to splits or sudden hose uncoupling;
- Process piping releases from failures at flanges, joints, welds, valves and valve seals, and drains or bleeds;
- Process vessel or pump releases due to cracks, seal failure, or drain, bleed, or plug failure;
- Vessel overfilling and spill, or overpressurization and venting through relief valves or rupture disks; and
- Shipping container mishandling or puncturing leading to a spill.

Alternative release scenarios for toxic substances should be those that lead to concentrations above the toxic endpoint beyond your fenceline. Scenarios for flammable substances should have the potential to cause substantial damage, including on-site damage. Those releases that have the potential to reach the public are of the greatest concern. You should consider unusual situations, such as start-up and shut-down, in selecting an appropriate alternative scenario.

For alternative release scenarios, you are allowed to consider active mitigation systems, such as interlocks, shutdown systems, pressure relieving devices, flares, emergency isolation systems, and fire water and deluge systems, as well as passive mitigation systems, as described in Sections 3.1.2 and 3.2.3.

For alternative release scenarios for regulated substances used in ammonia refrigeration, chemical distribution, propane distribution, warehouses, or POTWs, consult EPA's risk management program guidance

documents for these industry sectors.

You have a number of options for selecting release scenarios for toxic or flammable substances.

- You may use your worst-case release scenario and apply your active mitigation system to limit the quantity released and the duration of the release.
- You may use information from your process hazards analysis, if you have conducted one, to select a scenario.
- You may review your accident history and choose an actual event as the basis of your scenario.
- If you have not conducted a process hazards analysis, you may review your operations and identify possible events and failures.

Whichever approach you select, the key information you need to define is the quantity to be released and the time over which it will be released; together, these allow you to estimate the release rate and use essentially the same methods you used for the worst-case analysis.

For flammable substances, the choice of alternative release scenarios is somewhat more complicated than for toxic substances, because the consequences of a release and the endpoint of concern may vary. For the flammable worst case, the consequence of concern is a vapor cloud explosion, with an overpressure endpoint. For alternative scenarios (e.g., fires), other endpoints (e.g., heat radiation) may need to be considered.

Possible scenarios involving flammable substances include:

- Vapor cloud fires (flash fires) may result from dispersion of a cloud of flammable vapor and ignition of the cloud following dispersion. Such a fire could flash back and could represent a severe heat radiation hazard to anyone in the area of the cloud. This guidance provides methods to estimate distances to a concentration equal to the lower flammability limit (LFL) for this type of fire. (See Sections 9.1, 9.2, and 10.1.)
- A pool fire, with potential radiant heat effects, may result from a spill of a flammable liquid. This guidance provides a simple method for estimating the distance from a pool fire to a radiant heat level that could cause second degree burns from a 40-second exposure. (See Section 10.2).
- A boiling liquid, expanding vapor explosion (BLEVE), leading to a fireball that may produce intense heat, may occur if a vessel containing flammable material ruptures explosively as a result of exposure to fire. Heat radiation from the fireball is the primary hazard; vessel fragments and overpressure from the explosion also can result. BLEVEs are generally considered unlikely events; however, if you think a BLEVE is possible at your site, this guidance provides a method to estimate the distance at which radiant heat effects might lead to second degree burns. (See Section 10.3.) You also may want to consider models or

calculation methods to estimate effects of vessel fragmentation. (See Appendix A for references that may provide useful information for estimating such effects.)

- For a vapor cloud explosion to occur, rapid release of a large quantity, turbulent conditions (caused by a turbulent release or congested conditions in the area of the release, or both), and other factors are generally necessary. Vapor cloud explosions generally are considered unlikely events; however, if conditions at your site are conducive to vapor cloud explosions, you may want to consider a vapor cloud explosion as an alternative scenario. This guidance provides methods you may use to estimate the distance to 1 psi overpressure for a vapor cloud detonation, based on less conservative assumptions than the worst-case analysis. (See Section 10.4.) A vapor cloud deflagration, involving lower flame speeds than a detonation and resulting in less damaging blast effects, is more likely than a detonation. This guidance does not provide methods for estimating the effects of a deflagration, but you may use other methods of analysis if you want to consider such events. (See Appendix A for references that may provide useful information.)
- A jet fire may result from the puncture or rupture of a tank or pipeline containing a compressed or liquefied gas under pressure. The gas discharging from the hole can form a jet that "blows" into the air in the direction of the hole; the jet then may ignite. Jet fires could contribute to BLEVEs and fireballs if they impinge on tanks of flammable substances. A large horizontal jet fire may have the potential to pose an offsite hazard. This guidance does not include a method for estimating consequence distances for jet fires. If you want to consider a jet fire as an alternative scenario, you should consider other models or methods for the consequence analysis. (See Appendix A for references that may provide useful information.)

If you carry out an alternative scenario analysis for a flammable mixture (i.e., a mixture that meets the criteria for NFPA 4), you need to consider all flammable components of the mixture, not just the regulated flammable substance or substances in the mixture (see Section 5.2 on flammable mixtures). If the mixture contains both flammable and non-flammable components, the analysis should be carried out considering only the flammable components.

Chapter 7 provides detailed information on calculating release rates for alternative release scenarios for toxic substances. If you can estimate release rates for the toxic gases and liquids you have on site based on readily available information, you may skip Chapter 7 and go to Chapter 8. Chapter 8 describes how to estimate distances to the toxic endpoint for alternative scenarios for toxic substances. Chapter 9 provides information on calculation release rates for flammable substances. Chapter 10 describes how to estimate distances to flammable endpoints.

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